

Feeding of the Yellow-tailed Black Cockatoo on Cossid Moth Larvae inhabiting *Acacia* species

by K. N. G. SIMPSON*

Summary

Some field observations are provided concerning activity of the Yellow-tailed Black Cockatoo *Calyptorhynchus funereus* Shaw, in searching for and extracting large wood-boring cossid moth larvae from wattle trees.

Three species of *Acacia* variably infested by larvae of *Xyleutes durvillei* (H-Sch) (Cossidae, Lepidoptera) were studied at Tidbinbilla, Australian Capital Territory.

The evidence indicates that a distinct routine for extraction of these larvae or pupae from tree-trunks and exposed lateral roots is followed. A discussion on possible methods of location of larvae in trees by the cockatoo is included.

Some local ecological factors limiting *C. funereus* attack, and tree destruction resulting from cossid and cockatoo damage, are discussed.

Introduction

On 25 August, 1963, four Yellow-tailed Black Cockatoos *Calyptorhynchus funereus* Shaw, were disturbed from a small stand of *Acacia dealbata* Link, marginal to a cleared valley at Tidbinbilla, Australian Capital Territory. Examination of the trees indicated that many had been torn open by the cockatoos in a search for large moth larvae tunnelling in the wood.

On 2 September, 1963, a single male Yellow-tailed Black Cockatoo was seen investigating *A. dealbata* saplings in the same stand of trees. The bird was observed through

binoculars for almost three minutes, after which it became alarmed and departed.

These observations, together with subsequent study of the trees concerned, give an indication of methods employed by the Yellow-tailed Black Cockatoo in locating and extracting large wood-boring moth larvae from small acacias, and in particular, an indication of damage caused by both bird and larvae, and some consequent effects to three different species of *Acacia*.

The observations recorded here are an incidental result of frequent and regular inspections of the area between August, 1962, and October, 1964. The author was then assisting in a mammal ecology study conducted by the Division of Wildlife Research, C.S.I.R.O.

PREVIOUS RECORDS

It has long been known that *C. funereus* causes considerable damage to various species of trees whilst extracting insect larvae, but there have been no detailed descriptions of such damage, and little attempt to study the method by which the cockatoos actually locate or extract wood-boring larvae. The few previous accounts of such damage are principally in the form of brief nature notes or passing comments in annotated bird lists.

Bennett (1834) recorded destruction of small trees in the Yass District of New South Wales by Black

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Cockatoos. Mellor (1906) in Tasmania, and Hyem (1936) at Barrington, N.S.W., give observations of Black Cockatoos searching for larvae on trunks of newly ring-barked stringy bark trees (*Eucalyptus* spp.). Fletcher (1908) noted *C. funereus* in Tasmania searching for large moth larvae in cut and stacked logs of "Black wattle" (presumably *Acacia mollissima* Wild).

There are also several published accounts of the boughs of trees being eaten completely through by *C. funereus*, e.g. Barnard (1924), Paterson (1928), Gray (in Crosbie-Morrison, 1949).

More recently Tindale (1953) discusses damage caused by moth larvae and subsequently by *C. funereus* in experimental plots of eucalyptus saplings grown by researchers of the Commonwealth Forestry Bureau at Taranna, Tasmania. The moth was described later as *Oeneutes paradiseus* Tindale (Hepialidae, Lepidoptera). Structural damage caused to saplings by the cockatoos resulted in losses of trees in strong winds. Tindale draws attention to the evident culling effect among natural stands of eucalyptus saplings resulting from interaction of cockatoo and moth. In the same paper, Tindale records some information from Mr. J. F. B. Common (Division of Entomology, C.S.I.R.O., Canberra, A.C.T.) concerning damage caused by *C. funereus* in gouging larval hepialids from Snow Gum, *E. niphophila* Maiden et Blakely, at 5,500 feet on Mt. Gingera, in the Brindabella Range, A.C.T. (the larvae proved to be a subspecies of the same moth, *O. p. montanus* Tindale). A brief note has been published concerning possible damage by *C. funereus* to the Grass-tree *Xanthorrhoea australis* R.Br., in an adjacent area of the Tidbinbilla District (Simpson, 1964).

ENVIRONMENT

The main study area is dissected by tributary water-courses of the Tidbinbilla River, and comprises six approximately parallel, low, and relatively mature easterly-trending granite ridges at the foot of Mt. Tidbinbilla (lat. 35°27'S., long. 148°54'E.). The area is approximately a square mile in extent, and is now part of the Tidbinbilla Native Fauna Reserve. Elevation above sea level is 2,500 feet approximately.

This area of the Tidbinbilla Range is covered with extensive and relatively dense wet sclerophyll forest. Much of the eucalypt forest up to one mile from the cleared valley margin comprises relatively thick secondary growth following heavy slashing over many years to obtain leaves for a local eucalyptus-oil still. The still ceased operating when the area was declared a Reserve.

Fairly dense clumps of *A. dealbata*, and of *A. falciformis* DC., occur throughout the region, but more particularly in marginal areas and on the rocky summits of small hills. The groups of saplings and trees may be quite separate, or the two species may adjoin each other, although such boundaries seem to remain sharply defined. *A. melanoxylon* R.Br. is also widespread but grows principally as single trees along or near to the water-courses.

A thick growth of introduced plants also grows along or near to many portions of the water-courses. These are mainly Blackberry *Rubus vulgaris* Weihe et Nees (*R. fruticosus* agg.), Raspberry *R. idaeus* L., and the Briar Rose *Rosa rubiginosa* L.

OBSERVED FEEDING BEHAVIOUR

The male Yellow-tailed Black Cockatoo observed on 2 September, 1963, investigating saplings of *A. dealbata*, did so by walking on the

ground between the trunks and giving each sapling in turn one or more bites at or just above ground level. The bird paused for approximately two or three seconds only at each tree before moving to the next. It was seen later that one or more bites (henceforth called "test bites") had been given to each trunk and to any exposed lateral roots. The cockatoo examined four or five trees in succession, turning its head to a horizontal plane for the bites to the vertical trunks ("lateral" bites).

Following a test bite indistinguishable from those preceding it, the cockatoo gave several strong lateral bites to a trunk, removing a large piece of bark and some underlying wood each time. The sap-wood was then stripped off, the bird's head being now held close to vertical in attitude (i.e. the head in its normal position in line with the body axis) and a downward levering motion adopted to rip out large splinters. Three or four bites were sufficient to breach the larval tunnel, and it was rapidly enlarged by a combination of lateral bites and downward leverings.

A whitish larva was seen to be extracted from the lowest portion of the hole thus made. The cockatoo used an upward pull to stretch the larva, followed by a relaxing of pressure, a sideways shaking of the head, and a further upward stretch. This process was repeated once to extract the larva. When free, the larva was transferred to the right foot and then eaten. The larva was estimated to be some three inches in length. Two more saplings were test bitten before the bird suddenly flew off, calling loudly.

IDENTIFICATION OF LARVAE

On 6 September, 1963, Mr. M. S. Upton (Division of Entomology, C.S.I.R.O., Canberra) accompanied the author in an examination of the

trees in the area and a number of larvae were collected. The large moth larvae sought by the Yellow-tailed Black Cockatoos were subsequently identified as *Xyleutes durvillei* (H-Sch) (Cossidae, Lepidoptera). The largest individual obtained was some five inches long and approximately an inch in diameter. Larvae of *X. durvillei* were subsequently obtained from each of the three species of acacia examined.

OTHER INSECT LARVAE

A plump, one-inch long larva of the Botany Bay Diamond Weevil *Chrysolophus spectabilis* Fab. (Chrysomelidae, Coleoptera) was also found in a lateral root of an *A. dealbata* sapling. A cockatoo had exposed the tunnel but had either failed to secure the larva or had rejected it.

Larvae of an unidentified cerambycid beetle species in some dead or dying *A. dealbata* in the study area, were believed to represent an incidental food item only. They were generally situated near to older, empty tunnels of the larger cossid larvae. Some of the cerambycid tunnels had been opened by *C. funereus*, but it could not be determined whether larvae had been secured.

LARVAL HABITS OF *X. durvillei* (H-Sch)

A brief resume of the larval habits of *Xyleutes durvillei* is appropriate to this paper.

The larvae are believed to live in the trees for three years or more before pupating (Littler, 1904, on *Zeuzera eucalypti* (H-Sch) = *X. durvillei* (H-Sch)).

The larvae excavate tunnels up to an inch in diameter in three different species of acacias in the study area. A few tunnels are found in branches, but most are situated either in the lower trunk and extending into the lateral

roots, or in the roots themselves. This is particularly so where these roots project above the ground. In the region of the lower trunk, the larvae occupy the centre of saplings up to about three inches in diameter. The tunnels are not particularly extensive.

At some point in the lower portion of the tunnel, a larger excavation permits the larva to turn around. This region may become a point of major structural weakness in small acacia saplings, more particularly if it is situated at the junction of the lateral roots and base of the trunk. Prior to pupation, the exit hole is enlarged and plugged with silk, and pupation takes place in a head-downward position at the uppermost portion of the tunnel. When emergence is due, the pupa works its way down the tube by the action of the tergal spines.

EXTRACTION OF LARVAE BY *C. funereus*

It is convenient to deal with the extraction technique before considering the problem of location of larvae by *C. funereus*.

Examination of more than two hundred extraction points on acacia trees in the area indicates that the procedure described is almost unvarying.

Small saplings offer little resistance to *C. funereus*, but larger trees may require a considerable amount of work before a larva can be obtained.

For larger trees, often with from half to one and a half inches of wood tissue between cavity and external surface, a very definite routine is practised for the actual extraction of large wood-boring larvae. The best development of the method is seen on trunks and large limbs, or on projecting lateral roots having a diameter generally greater than about two inches (see Plate I).

The observations indicate that once the position of a larva or tunnel has been ascertained, lateral bites are made directly over the uppermost portion of the tunnel and again several inches or more below this point.

The bark is then stripped off to form a roughly rectangular working area. Following this, the sapwood is removed by tearing splinters out and nipping each of them off at top and bottom until the uppermost portion of the tunnel can be penetrated. Occasionally, further work by the bird may then cease (see below). Normally, however, the cavity is enlarged progressively downward, until the opening is large enough for the larva or pupa to be extracted.

The observations indicate that the upper limit of each cossid tunnel is determined and penetrated with great precision — to approximately an inch in every instance examined.

Initial penetrations ("inspection holes") had been made by *C. funereus* in a number of larval burrows in small sapling bases or roots, but work had ceased immediately the interior was breached. An examination of such cavities revealed that they were either empty, the imago having emerged during a previous season, or that the pupal chamber was occupied by an empty pupal case. In such instances, the pupa had been parasitized and destroyed *in situ*. On a few occasions, fresh cockatoo inspection holes were found in completely dead branches still attached to living trees. Larval cossids, and the subsequent cerambycid larvae that often frequent dead or dying trees, had long gone from these branches, which appeared to be several years old.

LOCATION OF COSSID LARVAE BY *C. funereus*

The location of cossid and other wood-boring insect larvae in trees by

C. funereus may be through application of a combination of several factors.

Larvae may be located by visual evidence on the external surface of trees at times. Trickies of chewed wood were frequently seen on the acacias with heavy infestations of cossid acacias with heavy infestations of cossids, and exudations of sap were sometimes observed also. Such evidence is dependant on the insect species concerned and the nature of the

damage it causes. However, where test bites are given to all apparently similar trees in a clump (e.g. of sapling acacias), it would indicate that visual determinations of larval burrow positions are probably not being made.

It is conceivable, therefore, that the test bite may fulfil any or all of three separate functions simultaneously:—

a. By the purely mechanical effect of pressure and resistance it may indicate the presence of a structural weakness in a tree (e.g. a larval

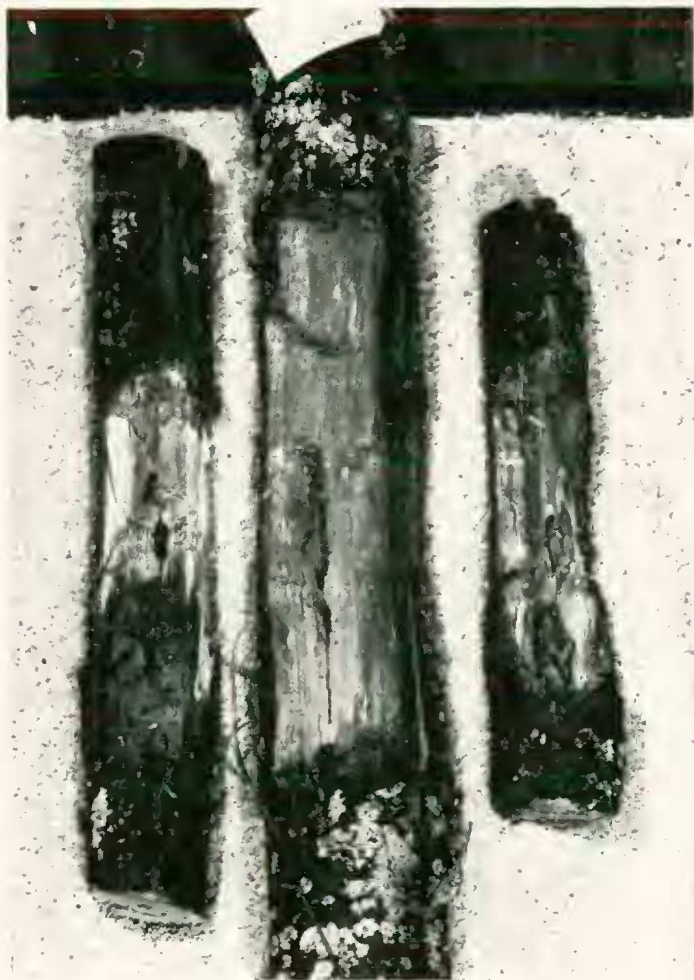


Plate 1. Trunks of *Acacia dealbata* trees from which Cossid moth larvae were extracted by Yellow-tailed Black Cockatoos. Tidbinbilla, A.C.T.

Photo by Graeme Chapman.

burrow). This may particularly apply in the case of test bites to small saplings.

h. The vibration of the bite itself may stimulate the larva or pupa to a response (e.g. movement) detectable by the bird. Crosbie-Morrison (1949), believed that cockatoos listened to the gnawings of larvae within the trees. Any rustling or scratching of contact between the burrow walls and the sclerotized surface of a moving larva or pupa possibly is also audible to the bird. However this explanation does not account for the observed ability of the bird to locate empty tunnels.

c. During contact with the tree (and perhaps as a result of b) the bill and (or) tongue may act as a sensory organ to detect movements of the insect. Vibrations received via the feet and legs may also contribute. It is known that in many birds, vibrational stimuli may be received exclusively by means of extremely sensitive vibration receptors (Herbst's Lamellar Corpuscles), which are often concentrated in the legs or about the oral cavity. In the *Picidae* (Woodpeckers), groups of these cells are prominent in the tongue, which is used for probing insect tunnels. It is also known that reception of vibrational stimuli is independent of hearing in birds (A. Portmann (in Marshall, 1960)).

SOME LOCAL ECOLOGICAL FACTORS

In the relatively small study area at Tidbinbilla, several variable ecological factors were observed and are outlined below.

(1) *Degree of infestation of acacias by cossid larvae*—As previously noted, the same species of cossid, viz. *X. durvillei*, was discovered in each of the three species

of *Acacia* examined. There was, however, a considerable variation in the degree of infestation within the area studied.

Of two adjacent small patches of *A. dealbata*, one group was heavily infested, and showed abundant evidence of both recent (1963) and prior damage by cockatoos. In the other patch of trees thirty yards away, all the trees showed recent test bites, but no sign of any further damage at any time. At the northern edge of the study area, a patch of *A. dealbata* was infested, but only a few trees in a contiguous clump of *A. falciformis* contained larvae. Elsewhere, two large *A. melanoxylon* trees, situated forty yards from a heavily infested clump of *A. falciformis*, showed no sign of attack by either cossids or cockatoos. Three of four adjacent *A. melanoxylon* growing beside a stream-course had sustained damage caused by cockatoos over a period of several years (degree of weathering of exposed wood was used as a basis to determine recent damage from that of prior years). The fourth tree was apparently identical in size and situation, but showed no sign of cossid infestation or of cockatoo attack.

(2) *Growth of blackberry, etc.*—It was seen that the access of cockatoos to trunks and lower limbs of many *A. melanoxylon* trees (and occasionally of *A. dealbata*), was frequently restricted by a dense growth of blackberry, raspberry and briar-rose. Although some of these acacias were infested by cossid larvae and showed evidence of previous cockatoo attack, only branches of such trees above the level of secondary growth had been investigated or damaged recently by cockatoos.

(3) *Nature of soil*—*C. funereus* investigating or endeavouring to obtain cossid larvae from lateral roots of acacias growing in the loose, silty or

sandy soils near water-courses, at times excavated holes up to four inches deep around such roots. They often succeeded in extracting larvae from roots leading below the soil surface.

Where soils were generally more stony, e.g. on the tops of hills, cockatoos made very little attempt to dig down alongside a root, and only occasional minor soil disturbances were noted. This applied more particularly to *A. falciformis* clumps.

(4) *Cossid parasites and empty tunnels*—The fact that *C. funereus* occasionally wasted time and effort in opening tunnels where the cossid larvae or pupae have been destroyed by obligate parasites, or from which pupae have emerged during earlier years, has been previously noted.

TYPES AND RESULTS OF DAMAGE TO ACACIAS

The characteristic types of damage commonly caused by *C. funereus* to trunks, trunk-bases and lateral roots of *Acacia* trees and saplings at Tidbinbilla are shown in photographs accompanying this paper.

Several successive causes were seen to contribute to ultimate collapse and destruction of *Acacia* saplings and trees in the study area and its surroundings. They can be roughly categorised as follows:—

(1) *Primary structural failure*—There is a considerable initial loss of *A. dealbata* saplings due to insecure root-hold and (or) overweight of the foliage of the crown. These factors contribute to tree losses under adverse weather conditions. The losses reach a peak when the small saplings and trees come into (literally) heavy flower between August and September annually. Occasionally, boughs of quite large *A. melanoxylon* were also seen to have collapsed after rain or wind owing to the weight of the foliage. *A. falciformis* seemed to be

the least affected by these causes.

(2) *Cossid and cockatoo damage*—The large size of cossid tunnels in the centres of small *A. dealbata* saplings is clearly shown in Plate 2. Collapsed saplings were often seen showing no trace of cockatoo damage, but simply broken off at the level of a recent larval tunnel.

The addition of severe wounds made by cockatoos to small saplings already weakened by large cossid tunnels, generally brought about their collapse within a few weeks or months.

Similar observations were made concerning *A. falciformis* saplings, except that the strength of the tree generally appears to be greater, and these may remain standing for a considerable period after sustaining damage. The same type of damage to trunks of large *A. melanoxylon* trees does not appear to seriously impair their growth. Collapse of some individual branches resulted from structural damage imposed by cockatoos.

(3) *Fungus infection and cerambycid infestation*—*A. dealbata* and *A. falciformis* generally showed infection by fungus some time after sustaining damage by cockatoos. In a few cases the infection appeared to spread throughout the tree. In most instances however, it was localised to the immediate area of damage although its weakening effect was usually sufficient to bring about the ultimate collapse of the tree. Individual large branches of *A. melanoxylon* were also lost owing to fungal decay of tissue surrounding local damage. The fungi concerned were not identified.

A few trees of *A. dealbata* became heavily infested with an unidentified species of wood-boring cerambycid beetle larvae, following cossid and cockatoo damage.

Plate 2. *Acacia dealbata* saplings from which Cossid moth larvae were extracted by Yellow-tailed Black Cockatoos. The larvae have occupied the base of the trunk, just above or into the lateral root. Tidbinbilla, A.C.T.

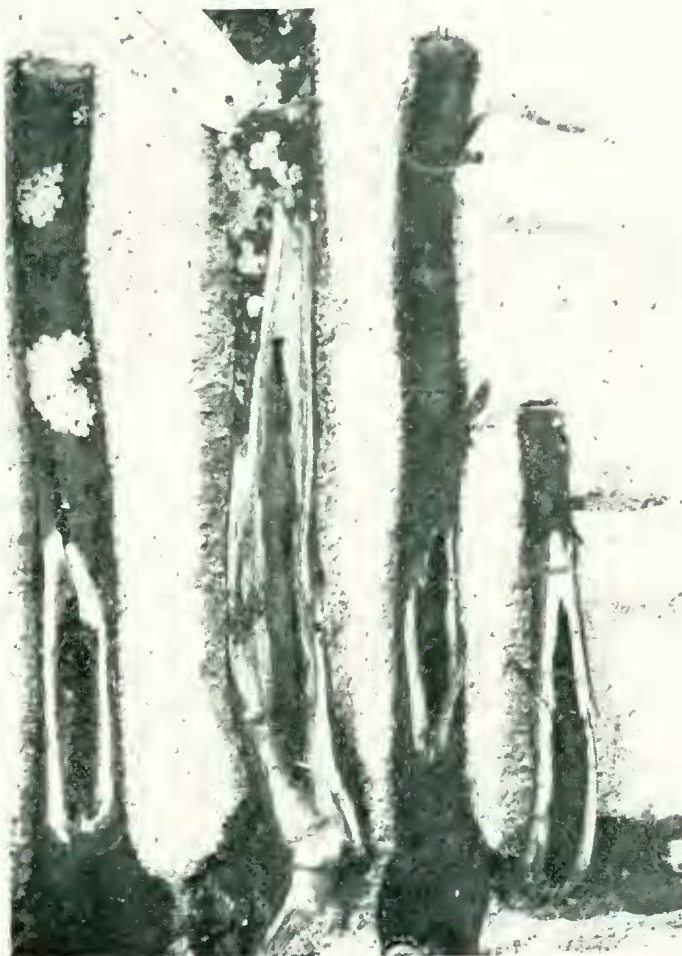


Photo by Graeme Chapman.

Plate 3. A larva of *Xyleutes durvillei* (Cossidae, Lepidoptera) from sapling of *Acacia dealbata*, Tidbinbilla, A.C.T., 1964.



Photo by Mr. M. S. Upton.

Acknowledgements

Reference to this work has been made by Forshaw (1969).

I am grateful to Mr. M. S. Upton, Division of Entomology, C.S.I.R.O., for assistance in the field and for insect identification, and to Mr. Max Gray, Division of Plant Industry, C.S.I.R.O., for plant identification.

From the Division of Wildlife Research, C.S.I.R.O., Dr. M. E. Griffiths generously provided time for me to complete field work associated with this study, Mr. Roy Coles assisted in the field, Mr. John H. Calaby read and criticised an early draft of this paper, and Mr. Gracme Chapman photographed specimens for me.

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